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CITY OF ELLENSBURG WASTEWATER TREATMENT PLANT CLASS II INSPECTION AUGUST 1988

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ABSTRACT

Ecology conducted a Class II inspection at Ellensburg's Wastewater Treatment Plant (WTP) on August 8-10, 1988. The plant met all NPDES permit requirements at the time of the inspection. Effluent quality was excellent. Influent wastewater was very dilute. Chlorine was found to be a major component of effluent toxicity as noted by a series of bioassays. Ellensburg's sludge contained very few contaminants. Sample splits compared generally very well. Several suggestions were made concerning laboratory procedures, influent sampling, and flow monitoring.

INTRODUCTION

A Class II inspection was conducted at the City of Ellensburg's Wastewater Treatment Plant (WTP) on August 8-10, 1988. The inspection was requested by John Hodgson and Harold Porath of Ecology's Central Regional Office. Conducting the inspection was Don Reif. Assistance was provided by Norm Glenn and Carlos Ruiz of Ecology's Compliance Monitoring Section, as well as Harold Porath. Stanley Miller, plant foreman, and Patty Garvey-Darda, interim laboratory technician, assisted from Ellensburg.

Survey objectives were to:

- Determine NPDES permit compliance during the inspection period.
- Review lab procedures on permitted parameters and assess analytical and sample collection parameters.
- Provide information on pollutants of concern, their reduction within the treatment system, and correlation with effluent bioassay results.
- Provide information for various agency planning projects on effluent and sediment bioassays.
- Provide information for use in reissuing the NPDES discharge permit.
- Determine sludge disposal concerns from a chemical perspective.
- Provide baseline data for future inspections.

LOCATION AND DESCRIPTION

The Ellensburg WTP is located south of town on Canyon Road near the Yakima River in Kittitas County (Figure 1). Secondary treatment facilities were completed in 1974. In 1981, a series of modifications were made, including additional solids handling facilities.

Treatment processes include: grit removal, comminution, activated sludge in completely-mixed aeration basins with floating aerators, secondary clarification, and chlorination (Figure 2). The outfall line discharges to the Yakima River. Secondary sludge is thickened by centrifugation prior to anaerobic digestion. Asphalt drying beds dewater the anaerobic sludge, which is then applied to designated sites near the WTP. Grit is disposed of by landfilling. Two supernatant lagoons can be used for storage of digester supernatant or sludge. Piping arrangement (not shown) includes flow from the digesters and a return line to the influent pump station.

The collection system serves primarily residential users, including septage from septic tanks. Wesco Wool Inc. is the main contributor of industrial wastewater to the WTP. A processor of sheep hides, Wesco pretreats their waste with aeration and peroxide prior to discharge. Wesco's waste is stored in an 18,000 gallon holding tank, then discharged through a one inch line to the WTP. Wesco notifies the plant of the time and volume of their discharges. Although infrequent, Wesco Wool discharged 15,000 and 10,000 gallons on August 8 and 9, respectively, according to WTP records. Also, Central Washington University (CWU) in Ellensburg handles many types of materials in their various labs that could enter the collection system.

METHODS

The sampling schedule, including field analyses, is listed in Table 1. Sampling locations are shown in Figure 2. A summary of analytical methods and references is listed in Appendix 1.

Twenty-four hour composited samples were taken at three locations: influent at the end of the grit chamber; unchlorinated effluent from the west secondary clarifier; and chlorinated effluent from the end of the chlorine contact chamber. Approximately 200 ml of sample were collected at 30-minute intervals.

General chemistry and priority pollutant scans were run on the influent sample. General chemistry parameters were run on the unchlorinated effluent sample, to compare with the WTP's regular sampling location. Effluent priority pollutant scan parameters and bioassays were run with chlorinated effluent. Samples for the bioassays consisted of three grabs composited during the three grab sampling periods. Also metals, organics, pesticides, and PCB's were tested on a sample of digested sludge.

Sediment samples were not collected. The Yakima River was running higher than usual and the outfall line and diffuser were not visible. Due to typically low suspended solids and high effluent quality, the WTP effluent has a low potential for causing negative impacts on sediment quality in the Yakima River.

Sediment from the supernatant lagoons was also not collected. The lagoons have been used for a number of years, but a recent drawdown showed minimal sludge accumulation. Therefore, disposal of lagoon sludge should not be needed for many years, and sludge characterization is unnecessary until then.

Three instantaneous flow measurements were made at the chlorine contact chamber weirs. In each case, height of flow over the metal weir edge was measured with a carpenter's square near both sides of each disinfection basin. These values were averaged to determine the flow rate over each side as shown in Appendix 2.

RESULTS

Flow

A flow of 4.11 MGD was recorded by the plant's flow meter totalizer. Ellensburg uses an in-line flow meter located in the chlorine contact chamber influent structure. Verification of flow rate using portable field flow meters was not possible. However, instantaneous measurements (as described in the Methods section) compared reasonably well with the WTP flow meter instantaneous readout (Appendix 2).

NPDES Permit Compliance

Ellensburg was well below permitted limits for all parameters during the inspection (Table 3). Effluent quality was excellent and plant operation appeared to be exemplary. Influent loadings were well below 85 percent of design criteria. However, a problem exists with the plant design. Several side streams drain back to the influent wet well. These include all plant floor drains, sinks, and bathrooms; supernatant lagoons; septage; drying bed supernatant; and centrate from the centrifuges. Since the influent sampling location is downstream of the wet well, it is impossible to collect a true raw influent sample. Therefore, the "true" influent strength is not known. This affects the 85 percent removal criteria in the permit as well as the 85 percent of design loading criteria. A means of collecting a raw influent sample needs to be devised.

While the exact figures of its strength may be in question, Ellensburg's influent is undoubtedly very weak, as shown in Appendix 3. The most likely explantion is infiltration and inflow (I & I) into the sewer collection system, aggravated by high summer ground water levels. Influent with these characteristics is harder to treat and relatively more costly per pound of BOD as well. Also, meeting 85 percent removal of BOD and TSS is much more difficult when concentrations are so low to begin with. An I & I reduction project would reduce plant operating costs and will be necessary if the 85 percent removal criteria are not able to be met in the future.

Effluent Bioassays

Effluent bioassays showed varying degrees of toxicity (Table 4). No significant acute toxicity was indicated by the trout test. The other three bioassays showed definite toxic response to the chlorinated effluent. These three bioassays were then retested after chlorine neutralization with sodium thiosulfate. Based on these results, chlorine was shown to be the major toxic component for *Daphnia* and *Ceriodaphnia*. The two-day *Daphnia pulex* test suffered 100 percent mortality initially but zero percent after chlorine neutralization. For *Ceriodaphnia*, adult mortality (an acute response) was 100 percent at 30 and 100 percent chlorinated effluent, compared to 10 percent mortality in the dechlorinated sample. For reproduction (chronic response), *Ceriodaphnia* toxicity decreased from a No Observed Effects Concentration of one percent effluent to 100 percent effluent after dechlorination. However, the reproduction portion was invalidated due to low control reproduction, a common problem with this test. Nonetheless, *Ceriodaphnia* followed a typical pattern of increased reproduction at low effluent concentrations due to nutrient enhancement, followed by toxicity override at higher effluent concentrations in the chlorinated sample. *Microtox* luminescence also increased upon dechlorination from a 15 minute EC_{50} of 12.3 percent effluent to 40.2 percent. Since considerable toxicity remained after dechlorination, chlorine may not have been the only toxicant present.

Further investigation of the cause and extent of the effluent toxicity is suggested. Wesco Wool's discharge would be a good place to start. Final effluent could be sampled over a several hour period during which Wesco Wool's discharge should be passing through the WTP. This type of sampling would help quantify the short-term toxic effects (if any) due to this influent stream. *Microtox* and *Ceriodaphnia* or the 7-day *Daphnia magna* bioassays are recommended.

Effluent Chemistry

General chemistry results are shown in Table 2. A full listing of priority pollutant scan results are included in Appendix 4.

Conventional parameters indicate a well-treated, high quality effluent with low BOD and suspended solids. Effluent nutrients were also very low, but this was due to a dilute influent rather than treatment removal. Nitrification did not appear to be occurring to a noticeable extent. No pesticides or PCB's were detected in the influent or effluent. Only a few effluent organic pollutants were found by the priority pollutant scan (Table 5). These compounds, all found at low concentrations, can be generally classified as either solvents or plasticizers (phthalates). The source is unknown, but may have been the college or Wesco Wool. Whatever the source, these materials may have entered the plant over a relatively short portion of the 24-hour compositing period. Concentrations may have, therefore, been much higher for a short time. The source of these compounds should be identified since plant performance could be impacted.

Effluent metals were, for the most part, fairly low (Table 6). Silver, however, equaled EPA's acute freshwater quality criterion and was thirty-three times the chronic criterion. Mercury exceeded the chronic criterion by a factor of seven, and cyanide was twice the criterion. According to EPA data (EPA, 1986), all three were at potentially toxic levels that could have affected the bioassays. However, the metals were analyzed as 'total' rather than 'total recoverable' as recommended by EPA for comparison with the water quality criteria. Since the 'total' method involves a more rigorous digestion, the bioavailability may have been overestimated. The influence of metals on effluent toxicity is therefore unclear.

Sludge Analyses

Ellensburg's sludge appeared to be considerably cleaner than most. Very few contaminants were found. No PCB's were detected, and only one BNA (Table 7). Bis(2-ethylhexyl)phthalate (BEHP), found at 2900 parts per billion, was detected in the effluent as well as the sludge. BEHP is a common contaminant, present in most plastic products. The only other organics found were two insecticides, Lindane and Heptachlor, at very low concentrations. These highly chlorinated compounds can be specifically used for leaf protection on fruit trees and for termite control, respectively (Meister Publishing Co., 1988). A full listing of chemical analyses is shown in Appendix 5.

Metals concentrations were also low. The total metals analysis and the extraction procedure toxicity test (EP TOX), to simulate leaching from a landfill, are listed in Table 8. Concentrations did not exceeded either set of criteria. Criteria from the state of Wisconsin are used as a "yardstick" since Ecology does not yet have freshwater sediment criteria.

Comparison of Sample Splits

In general, the sample splits agreed very well between Ellensburg and Ecology's laboratories. TSS and BOD_5 comparison was excellent for all samples except the Ellensburg influent sample (Table 9). Ecology identified this sample to be significantly stronger (especially for BOD) than Ecology's influent sample (Table 2). This is possible since Ecology's sample was collected on a timed basis, while Ellensburg's samples are flow proportioned. Also, high strength septage could have contributed. A load of septage would pass through the influent wet well rather quickly. If only one compositor sampled during this period the composited sample could be significantly different.

Fecal coliform results were acceptable but varied more than is desirable. A significant influence could be related to methodology. Ecology's coliform testing method was by membrane filtration, whereas Ellensburg's sample was run by the Most Probable Number (MPN) method by the CWU lab.

Laboratory Procedures Review

A review of Ellensburg's laboratory procedures indicated a clean and well organized lab, but several suggestions were noted. For the BOD test, sample bottles occasionally have less than the minimum 2.0 mg/l of oxygen depletion. Higher effluent dilutions are recommended to avoid this. Also, the dilution water blank occasionally has greater than the allowable 0.2 mg/l depletion. The cause(s) need to be identified and resolved. For saving time, one BOD bottle per dilution is allowable when a D.O. meter is used instead of the titration method. Ellensburg contracts out their fecal coliform analyses to the CWU lab; therefore, this procedure was not reviewed.

Several procedural suggestions for TSS analysis were made. For NPDES reporting, filters should be pre-washed, dried, and cooled in a desiccator before the initial weighing. The desiccator should have an effective humidity indicator. The filters should be seated onto the filtering base with distilled water prior to sample filtration. Again, the filter with sample must be cooled in the desiccator prior to final weighing. A follow-up lab visit was conducted by Otis Hampton, Ecology's roving operator/plant consultant.

SUMMARY AND RECOMMENDATIONS

Ellensburg's wastewater treatment plant was operating very well during the inspection. All parameters were well within NPDES permitted limits and effluent quality was excellent.

Some effluent toxicity was noted by the bioassays. Trout were unaffected, but *Daphnia pulex*, *Ceriodaphnia dubia*, and *Microtox* indicated definite toxicity. Chlorine was found to be a major cause of the toxicity. The cause of the remaining toxicity is unknown, but may have been caused by metals, notably silver and mercury, or cyanide.

Ellensburg's sludge was very clean from a chemical contaminant perspective. Only a few organic compounds (a phthalate and two insecticides), at very low concentrations, were detected. Land disposal concerns should be very low.

In general, sample splits compared well. The lab was clean and well organized. Several recommendations, as listed in the Laboratory Procedures Review section, were made to assure that accepted protocols are followed. A follow-up visit was conducted by Otis Hampton, Ecology's plant operations consultant, to address these points.

Excessive sewer system infiltration causes the Ellensburg WTP to experience very dilute influent wastewater during the summer months. Reduced infiltration would reduce WTP operating costs and may be needed in the future to meet 85 percent reduction of BOD and TSS.

The following specific recommendations are made:

- A way to collect a true influent sample, without side streams, should be explored. This is needed to properly evaluate removal efficiencies and plant loadings.

- A means to independently verify plant flow rate should be found. Flow rate affects NPDES compliance and plant loadings, and needs to be verifiable by portable flow meter.

- Further evaluation of effluent toxicity is needed to determine variability and source, especially if further testing shows continued toxicity.

REFERENCES

Ecology, 1982. Chemical Testing Methods For Complying with the State of Washington Dangerous Waste Regulation. WDOE 83-13. Washington Department of Ecology. March 1982, revised July 1983.

EPA, 1986. Quality Criteria For Water. EPA 440/5-86-001, 1986.

Hallinan, P., 1988. Metals Concentrations Found During Ecology Inspections of Municipal Wastewater Treatment Plants. Ecology memorandum to John Bernhardt: April 11, 1988.

Leupold & Stevens, Inc., 1978. Stevens Water Resources Data Book, Third Edition. Beaverton, Oregon. April 1978.

Meister Publishing Co., 1988. Farm Chemicals Handbook '88. Meister Publishing Company, Willoughby, Ohio 44094.

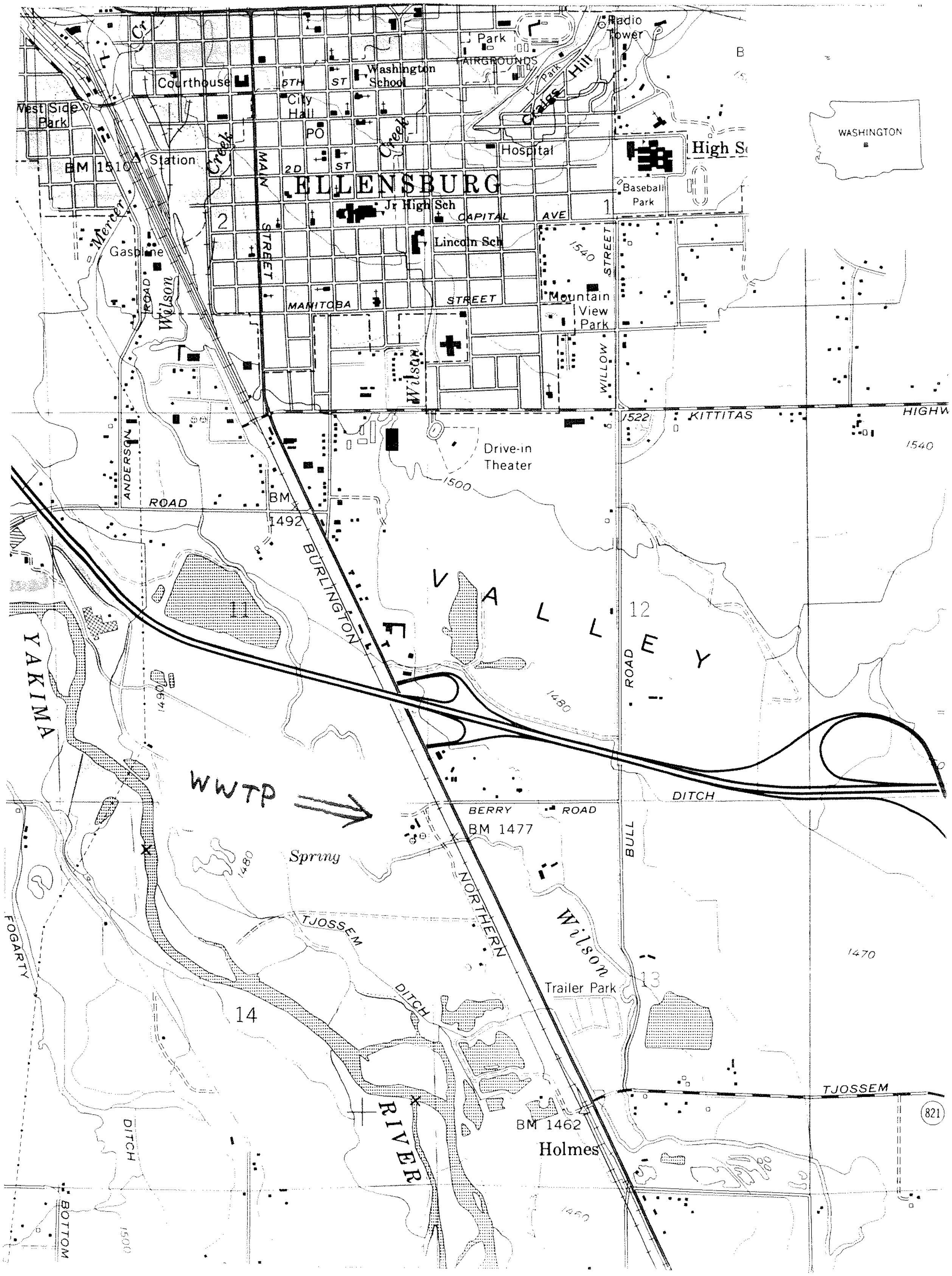

Figure 1. Plant Location Map: Ellensburg Class II Inspection- August 8-10, 1988.

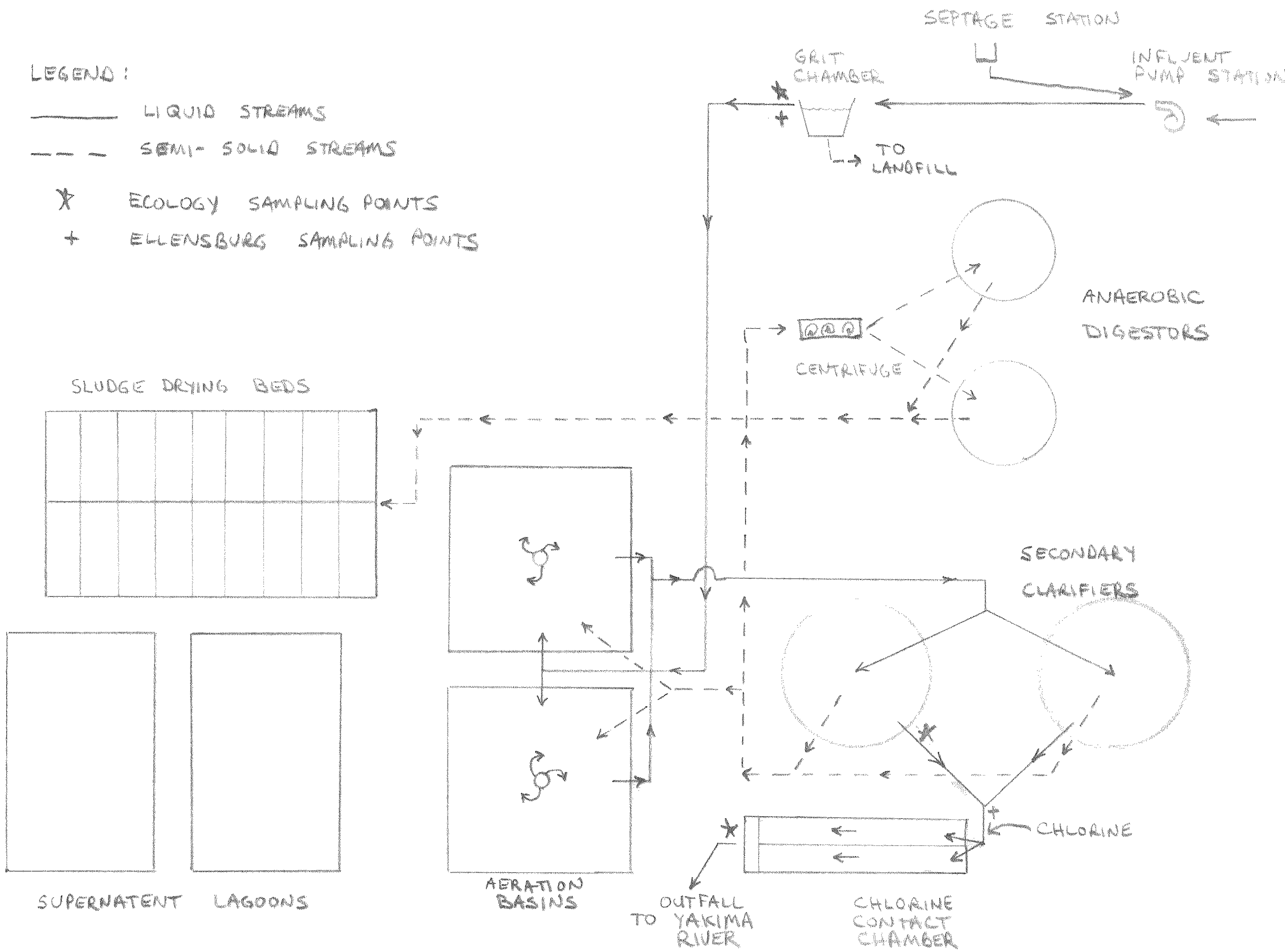

Figure 2. Treatment Plant Schematic With Sampling Locations: Ellensburg Class II Inspection - August 8 - 10, 1988.

Table 1. Sampling Schedule: Ellensburg Class II Inspection - August 8-10, 1988.

Analysis	Sample: Date: Type: Lab log #:	Inf-AM 08/09/88 grab 338083	Inf-PM 08/09/88 grab 338085	Inf-AM 08/10/88 grab 338088	Eff-AM 08/09/88 grab 338084	Eff-PM 08/09/88 grab 338086	Eff-AM 08/10/88 grab 338089	Inf-ECO 08/9-10 composite 338090	Inf-ELL 08/9-10 composite 338091	Eff-ECO 08/9-10 composite 338092	Eff-ELL 08/9-10 composite 338093	Sludge 08/9-10 composite 338094
Field:												
pH		X	X	X	X	X	X	X	X	X	X	
Conductivity		X	X	X	X	X	X	X	X	X	X	
Temperature		X	X	X	X	X	X	X	X	X	X	
Chlorine residual:												
Free:						X	X					
Total:						X	X					
General Chemistry:												
pH		X	X	X	X	X	X	X	X	X	X	
Turbidity		X	X	X	X	X	X	X	X	X	X	
Conductivity		X	X	X	X	X	X	X	X	X	X	
Alkalinity		X	X	X	X	X	X	X	X	X	X	
Hardness								X		X		
NH_3		X	X	X	X	X	X	X	X	X	X	
NO_3+NO_2		X	X	X	X	X	X	X	X	X	X	
T-Phosphate		X	X	X	X	X	X	X	X	X	X	
NO_2-N, Diss.								X	X	X	X	
Solids, Total								X	X	X	X	
Solids, T-NonVol								X	X	X	X	
Solids, NV-Susp								X	X	X	X	
Solids, T-Susp		X	X	X	X	X	X	X	X	X	X	
COD		X	X	X	X	X	X	X	X	X	X	
BOD_5								X	X	X	X	
Fecal Coliform						X	X					
Cyanide								X		X		
TOC												X
% Solids												X
Priority Pollutants:												
VOA (water)								X		X		
BNA (water)								X		X		
BNA (solids)												X
Pest/PCB (water)								X		X		
Pest/PCB (solids)												X
pp metals								X		X		X
EP TOX												X
Bioassays:												
Trout										X		
Daphnia pulex										X		
Microtox										X		
Ceriodaphnia dubia										X		

Table 2. Summary of General Chemistry Data: Ellensburg Class II Inspection - August 8-10, 1988.

Analysis	Station: Date: Time:	Inf-AM 08/09/88 8:14	Inf-PM 08/09/88 15:23	Inf-AM 08/10/88 9:50	Eff-AM 08/09/88 8:30	Eff-PM 08/09/88 15:31	Eff-AM 08/10/88 10:05	Inf-ECO 08/9-10 8:54-8:24	Inf-ELL 08/9-10 8:45-8:15	Eff-ECO 08/9-10 9:20-8:50	Eff-ELL 08/9-10 9:05-8:35
Field:											
pH	std. units	7.17	7.55	7.17	7.26	7.22	7.31	7.33	7.18	7.45	7.68
Conductivity	umho/cm	350	894	352	424	422	384	428	505	425	424
Temperature	deg. C.	18.5	19.4	18.4	18.0	19.8	18.1	5.0	11.8	6.5	11.8
Chlorine residual:											
Free:	mg/l					0.6	0.6				
Total:	mg/l					0.8	0.8				
Laboratory:											
pH	std. units	7.1	7.1	7.0	7.1	7.2	7.3	7.0	7.0	7.5	7.6
Turbidity	NTU	29	64	40	1	1	1	24	38	2	2
Conductivity	umho/cm	383	920	375	436	427	402	457	531	441	440
Alkalinity	mg/l	140	170	150	130	130	120	130	140	130	130
Hardness	mg/l							103		104	
NH_3	mg/l	5.6	4.9	6.1	2.4	1.9	0.98	4.4	4.7	2.0	1.8
NO_3+NO_2	mg/l	0.61	0.39	0.55	0.11	0.05	0.12	0.41	0.22	0.05	0.41
T-Phosphate	mg/l	2.5	3.2	3.8	1.8	1.2	0.53	2.3	2.7	1.5	1.6
NO_2-N, Diss.	mg/l							0.07	0.02	0.04	0.05
Solids, Total	mg/l							370	410	240	240
Solids, T-NonVol	mg/l							210	260	180	190
Solids, NV-Susp	mg/l							12	36	1	1
Solids, T-Susp	mg/l	100	110	500	3	5	1	68	100	6	3
COD	mg/l	160	490	390	20	24	18	200	250	32	21
BOD_5	mg/l							120	220	14	8
Fecal Coliform	#/100 ml					6	23				
Cyanide	mg/l							0.004		0.012	

Table 3. Comparison of Inspection Results to NPDES Permit Limits - Ellensburg Class II Inspection: August 8-10, 1988.

Parameter	Effluent Limits: Monthly Average	Effluent Limits: Weekly Average	Inspection Results	Plant Loading (lbs/day): Design Criteria[1]	Plant Loading (lbs/day): 85 % of Design Criteria	Plant Loading (lbs/day): Inspection Results
BOD_5: mg/l	30	45	14			
lb/day*	1200	1800	480	10,000	8500	4100
% removal	85	-	91			
TSS, mg/l	30	45	6			
lb/day*	1200	1800	206	8000	6800	2300
% removal	85	-	88			
Fecal Coliform, #/100 ml	200	400	6, 23			
pH	6.0-9.0		7.26, 7.22, 7.31			
Flow, MGD			4.11	8	6.8	4.11

* - loadings based on flow of 4.11 MGD from Ellensburg's flow meter.

\+ - Ecology's composite sample is used for BOD and TSS; pH is from field data.

1 - from the fact sheet, NPDES Permit #WA-002434-1.

Table 4. Effluent Bioassay Results: Ellensburg Class II Inspection - August 8-10, 1988.

96-hour Rainbow trout (Salmo gairdneri) - 100% concentration

	# of live test organisms: Initial	Final	Percent Mortality
Effluent	30	30	0
Control	30	30	0

48-hour Daphnia pulex - 100% concentration

	# of live test organisms: Start	End	Percent Mortality
Effluent:			
chlorinated	20	0	100
dechlorinated	20	20	0
Control:			
chlorinated	20	19	5
dechlorinated	20	20	0

Microtox

	EC_{50}: 5 min.	15 min.	30 min.
Effluent:			
chlorinated	20.2	12.3	-
dechlorinated	41.1	40.2	37.1

10-day Ceriodaphnia dubia

% chlorinated effluent:	% adult survival	avg.# young /adult*	% dechlorinated effluent:	% adult survival	avg.# young /adult*
0 (control)	90	10.9	0 (control)	80	3.8
1	90	14.0	1	60	8.2
3	40	20.8	3	60	7.8
10	90	8.0	10	90	9.9
30	0	0	30	90	9.0
100	0	0	100	90	17.0
NOEC - 1%			NOEC - 100%		
LOEC - 3%			LOEC - N/A		
LC_{50} - 21.5%			LC_{50} - N/A		

* - reproduction portions of the tests were not validated because average control reproduction was <15.

LC_{50} - concentration lethal to 50% of the organisms.
EC_{50} - concentration causing the tested effect to 50% of the organisms.
NOEC - No Observed Effect Concentration: the highest concentration of effluent that did not cause an observable adverse effect.
LOEC - Lowest Observed Effect Concentration: the lowest concentration of effluent that caused an observable adverse effect.

Table 5. VOA and BNA Organics Detected in Water Samples: Ellensburg Class II Inspection - August 8-10, 1988.

Station:	Inf-Eco	Eff-Eco
Type:	comp.	comp.
Date:	08/9/88	08/9/88
VOA Compounds (ug/L)		
Methylene Chloride	2.8 B	5.9 B
Acetone	47	0.6 U
Chloroform	0.9 M	1.3
Tetrachloroethene	5.9	4.9
Toluene	3.5	0.6 U
Ethylbenzene	1.2	1.0 U
Total Xylenes	10	1.5 U
Cyanide, Total (ug/L)	4	12
Phenols, Total (ug/L)	8	5 U
BNA Compounds (ug/L)		
Benzyl Alcohol	2 J	5 U
4-Methylphenol	2 M	1 U
Pentachlorophenol	5 U	2 M
Di-n-Butyl Phthalate	2 M	1 U
Butylbenzylphthalate	2 M	1 U
Bis(2-Ethylhexyl)phthalate	13	1 U

U Indicates compound was analyzed for but not detected at the given detection limit.

J Indicates an estimated value when result is less than specified detection limit.

B This flag is used when the analyte is found in the blank as well as the sample. Indicates possible/probable blank contamination.

M Indicates an estimated value of analyte found and confirmed by analyst but with low spectral match parameters.

Table 6. Comparison of Metals and Cyanide Detected in Water Samples to Water Quality Criteria: Ellensburg Class II Inspection - August 8-10, 1988. All values are ug/l.

	Sample:	Inf-Eco	Eff-Eco	Criteria	
	Type:	comp.	comp.		
	Date:	08/9/88	08/9/88	FW Acute	FW Chronic
Antimony		2 U	2	9000	1600
Arsenic		1.7	1.4	-	-
Copper		38	3	18	12
Lead		7.7	2.4	86	3
Mercury		0.099	0.08	2.4	0.012
Nickel		32	23	1900	98
Selenium		0.8	0.4	260	35
Silver		7	4	4	0.12
Thallium		0.3	0.3	1400	40
Zinc		85	26	332	47
Hardness			104 *		
Cyanide		4	12	22	5.2

U Indicates compound was analyzed for but not detected at the given detection limit.

* mg/L. The criteria for many of the metals is hardness-dependent. The effluent hardness value was used to calculate these criteria.

Table 7. BNA and Pesticides Detected in Sludge: Ellensburg Class II Inspection - August 8-10, 1988.

	Sludge (ug/kg dw)	LAET-UTOX(1)	New LAET(2)	ACR NOEC(3)	PSDDA SL(4)
BNA compounds:					
Bis(2-Ethylhexyl)phthalate	2900	1300	1300	310	3100
Pesticides:					
gamma-BHC (Lindane)	1.3 J				
Heptachlor	0.8 J				

J Indicates an estimated value when result is less than the specified detection limit.

(1) 1988 Lowest Apparent Effects Threshold Value excluding the Microtox value.
(2) 1988 Lowest Apparent Effects Threshold Value.
(3) Acute to Chronic Ratio No Observable Effects Concentration as reported in Contaminated Sediments Criteria Report, August 1988, PTI Environmental Services, i.e., Highest Apparent Effects Threshold Value, whichever is lower.
(4) Puget Sound Dredged Disposal Analysis Screening Level (SL), i.e., the 1986 Highest Apparent Effects Threshold Value divided by 10. The SL is defined as no lower than mean reference area values and no higher than the 1986 lowest apparent effects threshold value.

Table 8. Sludge Metals Results and Comparison to Criteria: Ellensburg Class II Inspection - August 8-10, 1988.

	mg/kg dw			ug/l	
Metal	PP metals	Criteria*	Previous Average**	EP TOX	Criteria+
Arsenic	0.27	10	-	50 U	5,000
Barium	-	-	-	210	100,000
Cadmium	0.35	1.0	7.6	5 U	1,000
Chromium	1.12	100	61.8	10 U	5,000
Copper	27.4	100	398	-	-
Lead	7.56	50	207	50 U	5,000
Mercury	-	0.10	-	0.08 U	200
Nickel	5.47	100	21.5	-	-
Selenium	0.38	-	-	129	1,000
Silver	0.94	-	-	6	5,000
Zinc	39.4	100	1200	-	-

* - Interim criteria for open-water disposal of dredged materials - Wisconsin Department of Natural Resources, 1985.

\+ - Dangerous waste maximum concentration: from Ecology, 1982.

** - Geometric mean of digested sludge metals from 34 activated sludge plants during previous Class II inspections (Hallinan, 1988).

Table 9. Comparison of Sample Splits: Ellensburg Class II Inspection - August 8-10, 1988.

Sample	Sampler	Laboratory	BOD5 (mg/l)	TSS (mg/l)	Fecal coliform (#/100ml)
Composites:					
Influent	Ecology	Ecology	120	68	
	Ecology	Ellensburg	132	74	
	Ellensburg	Ecology	220	100	
	Ellensburg	Ellensburg	124	73	
Effluent	Ecology	Ecology	14	6	23
	Ecology	Ellensburg	13	10	
	Ellensburg	Ecology	8	3	
	Ellensburg	Ellensburg	7.8	6	80

Appendix 1. Laboratory Analytical Methods: Ellensburg Class II Inspection - August 8-10, 1988.

Analysis	Method	Laboratory
TOC (solids)	APHA, 1985: #505	Laucks Testing Labs; Seattle, WA
VOA (water)	EPA, 1984: #624	Analytical Resources Inc., Seattle, WA
BNA (water)	EPA, 1984: #625	Analytical Resources Inc., Seattle, WA
BNA (solids)	EPA, 1986: #8270	Analytical Resources Inc., Seattle, WA
Pest/PCB (water)	EPA, 1984: #608	Analytical Resources Inc., Seattle, WA
Pest/PCB (solids)	EPA, 1986: #8080	Analytical Resources Inc., Seattle, WA
Metals	EPA, 1983: #200 series	Ecology; Manchester, WA
Cyanide (water)	EPA, 1983: #335.2-1	Ecology; Manchester, WA
Trout 96-hour	Ecology, 1981	Ecology; Manchester, WA
Daphnia pulex	EPA, 1985	Ecology; Manchester, WA
Microtox	Beckman	Ecology; Manchester, WA
Ceriodaphnia dubia	EPA, 1985	Ecology; Manchester, WA

APHA-AWWA-WPCF, 1985. Standard Methods for the Examination of Water and Wastewater, 16th ed.

Ecology, 1981. Static Acute Fish Toxicity Test, July 1981 revision. DOE 80-12.

EPA, 1983. Methods for Chemical Analysis of Water and Wastes, 600/4/79-020, revised March 1983.

EPA, 1984. 40 CFR Part 136, October 26, 1984.

EPA, 1985. Methods for Measuring the Acute Toxcicity of Effluents of Freshwater and Marine Organisms. EPA/600/4-85/013.

EPA, 1986. Test Methods for Evaluating Solid Waste Physical/Chemical Methods, SW-846, 3rd ed., November 1986.

Beckman. Microtox System Operating Manual.

Appendix 2. Summary of Flow Measurement Calculations: Ellensburg Class II Inspection- August 8-10, 1988.

	Water height, inches			
	West Weir	East Weir	Calculated Flow, MGD	Instantaneous WTP meter readout, MGD
Time: 8/9 0915	2 6/12, 2 3/8 (2.44)	2 1/2, 2 1/2 (2.5)	4.22	5.0
1500	2 8/12, 2 7/12 (2.63)	2 9/12, 2 9/12 (2.75)	4.79	4.5
8/10 1022	2 7/12, 2 1/2 (2.54)	2 7/12, 2 7/12 (2.58)	4.46	4.4

Equation: Q = [3.33LH(1.5)]x0.6463*

where Q = MGD (4.11)
L = Weir length, ft. (10.5 ft. each)
H = height of water, ft.

* - from Leupold & Stevens, 1978.

Appendix 3. Comparison of Influent Concentrations to Typical Municipal Influent Concentrations: Ellensburg Class II Inspection - August 8-10, 1988

Constituent	Concentration, mg/l+ Strong	Medium	Weak	Ellensburg Influent*
Solids, total	1200	720	350	370
total non-volatile	525	300	145	210
suspended	350	220	100	68
suspended non-volatile	75	55	20	12
BOD_5	400	220	110	120
COD	1000	500	250	200
Alkalinity	200	100	50	130
Nitrogen, ammonia	50	25	12	4.4
Phosphorus, total	15	8	4	2.3

+ - from EPA/600/6-85/002a, Water Quality Assessment: A Screening Procedure for Toxic and Conventional Pollutants in Surface and Ground Water - Part 1 (Revised 1985).

* - Ecology composite sample results.

Appendix 4. Results of VOA, BNA, Pest/PCB and Metal Priority Pollutant Scans for Water Samples: Ellensburg Class II Inspection - August 8-10, 1988.

Sample:	Inf-Eco	Eff-Eco
Lab Log #:	338090	338092
Type:	comp.	comp.
Date:	08/09/88	08/09/88
VOA Compounds (ug/L)		
Chloromethane	2.9 U	2.9 U
Bromomethane	0.9 U	0.9 U
Vinyl Chloride	1.1 U	1.1 U
Chloroethane	0.9 U	0.9 U
Methylene Chloride	2.8 B	5.9 B
Acetone	47	0.6 U
Carbon Disulfide	2.0 U	2.0 U
1,1-Dichloroethene	1.3 U	1.3 U
1,1-Dichloroethane	1.1 U	1.1 U
Trans-1,2-Dichloroethene	1.1 U	1.1 U
Cis-1,2-Dichloroethene	1.2 U	1.2 U
Chloroform	0.9 M	1.3
2-Butanone	1.0 U	1.0 U
1,2-Dichloroethane	0.6 U	0.6 U
1,1,1-Trichloroethane	1.0 U	1.0 U
Carbon Tetrachloride	0.5 U	0.5 U
Vinyl Acetate	1.7 U	1.7 U
Bromodichloromethane	0.2 U	0.2 U
1,2-Dichloropropane	0.6 U	0.6 U
Trichloroethene	0.8 U	0.8 U
Benzene	0.4 U	0.4 U
Dibromochloromethane	0.9 U	0.9 U
1,1,2-Trichloroethane	0.3 U	0.3 U
Bromoform	0.3 U	0.3 U
4-Methyl-2-Pentanone	1.8 U	1.8 U
2-Hexanone	1.3 U	1.3 U
1,1,2,2-Tetrachloroethane	0.6 U	0.6 U
Tetrachloroethene	5.9	4.9
Toluene	3.5	0.6 U
Chlorobenzene	0.6 U	0.6 U
trans-1,3-Dichloropropene	0.5 U	0.6 U
Ethylbenzene	1.2	1.0 U
cis-1,3-Dichloropropene	0.6 U	0.5 U
Styrene	0.5 U	0.5 U
Total Xylenes	10	1.5 U
2-Chloroethylvinylether	1.5 U	1.5 U
Trichlorofluoromethane	1.0 U	1.0 U
1,1,2-Trichloro-1,2,2-trifluoroethane	1.0 U	1.0 U
Cyanide, Total (mg/L)	0.004	0.012
Phenols, Total (ug/L)	8	5 U

Appendix 4. Continued.

	Sample:	Inf-Eco	Eff-Eco
	Lab Log #:	338090	338092
	Type:	comp.	comp.
	Date:	08/09/88	08/09/88

BNA Compounds (ug/L)

Phenol	1 U	1 U
Bis(2-Chloroethyl)Ether	1 U	1 U
2-Chlorophenol	1 U	1 U
1,3-Dichlorobenzene	1 U	1 U
1,4-Dichlorobenzene	1 U	1 U
Benzyl Alcohol	2 J	5 U
1,2-Dichlorobenzene	1 U	1 U
2-Methylphenol	1 U	1 U
Bis(2-chloroisopropyl)ether	1 U	1 U
4-Methylphenol	2 M	1 U
N-Nitroso-Di-n-Propylamine	1 U	1 U
Hexachloroethane	2 U	2 U
Nitrobenzene	1 U	1 U
Isophorone	1 U	1 U
2-Nitrophenol	5 U	5 U
2,4-Dimethylphenol	2 U	2 U
Benzoic Acid	10 U	10 U
Bis(2-Chloroethoxy)Methane	1 U	1 U
2,4-Dichlorophenol	3 U	3 U
1,2,4-Trichlorobenzene	1 U	1 U
Naphthalene	1 U	1 U
4-Chloroaniline	3 U	3 U
Hexachlorobutadiene	2 U	2 U
4-Chloro-3-Methylphenol	2 U	2 U
2-Methylnaphthalene	1 U	1 U
Hexachlorocyclopentadiene	5 U	5 U
2,4,6-Trichlorophenol	5 U	5 U
2,4,5-Trichlorophenol	5 U	5 U
2-Chloronaphthalene	1 U	1 U
2-Nitroaniline	5 U	5 U
Dimethyl Phthalate	1 U	1 U
Acenaphthylene	1 U	1 U
3-Nitroaniline	5 U	5 U
Acenaphthene	1 U	1 U
2,4-Dinitrophenol	10 U	10 U
4-Nitrophenol	5 U	5 U
Dibenzofuran	1 U	1 U
2,4-Dinitrotoluene	5 U	5 U
2,6-Dinitrotoluene	5 U	5 U
Diethyl Phthalate	1 U	1 U
4-Chlorophenyl-Phenylether	1 U	1 U
Fluorene	1 U	1 U
4-Nitroaniline	5 U	5 U

Appendix 4. Continued.

Sample:	Inf-Eco	Eff-Eco
Lab Log #:	338090	338092
Type:	comp.	comp.
Date:	08/09/88	08/09/88
4,6-Dinitro-2-Methylphenol	10 U	10 U
N-Nitrosodiphenylamine	1 U	1 U
4-Bromophenyl-Phenylether	1 U	1 U
Hexachlorobenzene	1 U	1 U
Pentachlorophenol	5 U	2 M
Phenanthrene	1 U	1 U
Anthracene	1 U	1 U
Di-n-Butyl Phthalate	2 M	1 U
Fluoranthene	1 U	1 U
Pyrene	1 U	1 U
Butylbenzylpthalate	2 M	1 U
3,3'-Dichlorobenzidine	5 U	5 U
Benzo(a)Anthracene	1 U	1 U
Chrysene	1 U	1 U
Bis(2-Ethylhexyl)phthalate	13	1 U
Di-n-Octyl Phthalate	1 U	1 U
Benzo(b)Fluoranthene	1 U	1 U
Benzo(k)Fluoranthene	1 U	1 U
Benzo(a)Pyrene	1 U	1 U
Indeno(1,2,3-cd)Pyrene	1 U	1 U
Dibenzo(a,h)Anthracene	1 U	1 U
Benzo(g,h,i)Perylene	1 U	1 U
<u>Pest/PCB Compounds (ug/L)</u>		
alpha-BHC	0.05 U	0.05 U
beta-BHC	0.05 U	0.05 U
delta-BHC	0.05 U	0.05 U
gamma-BHC (Lindane)	0.05 U	0.05 U
Heptachlor	0.05 U	0.05 U
Aldrin	0.05 U	0.05 U
Heptachlor Epoxide	0.05 U	0.05 U
Endosulfan I	0.15 U	0.15 U
Dieldrin	0.10 U	0.10 U
4,4'-DDE	0.10 U	0.10 U
Endrin	0.10 U	0.10 U
Endosulfan II	0.10 U	0.10 U
4,4'-DDD	0.10 U	0.10 U
Endosulfan Sulfate	0.10 U	0.10 U
4,4'-DDT	0.10 U	0.10 U
Methoxychlor	0.20 U	0.20 U
Endrin Ketone	0.10 U	0.10 U
alpha-Chlordane }		
gamma-Chlordane }	0.50 U	0.50 U
Toxaphene	5.0 U	5.0 U

Appendix 4. Continued.

	Sample:	Inf-Eco	Eff-Eco
	Lab Log #:	338090	338092
	Type:	comp.	comp.
	Date:	08/09/88	08/09/88
Aroclor-1016		1.0 U	1.0 U
Aroclor-1221		1.0 U	1.0 U
Aroclor-1232		1.0 U	1.0 U
Aroclor-1242		1.0 U	1.0 U
Aroclor-1248		1.0 U	1.0 U
Aroclor-1254		1.0 U	1.0 U
Aroclor-1260		1.0 U	1.0 U
Priority pollutant metals (ug/l)			
Antimony		2 U	2
Arsenic		1.7	1.4
Beryllium		1 U	1 U
Cadmium		5 U	5 U
Chromium		10 U	10 U
Copper		38	3
Lead		7.7	2.4
Mercury		0.099	0.08
Nickel		32	23
Selenium		0.8	0.4
Silver		7	4
Thallium		0.3	0.3
Zinc		85	26

U Indicates compound was analyzed for but not detected at the given detection limit.

J Indicates an estimated value when result is less than specified detection limit.

B This flag is used when the analyte is found in the blank as well as the sample. Indicates possible/probable blank contamination.

M Indicates an estimated value of analyte found and confirmed by analyst but with low spectral match parameters.

Appendix 5. Results of BNA, Pest/PCB and metal scans of sludge sample: Ellensburg Class II inspection- August 8-10, 1988.

Station	DigSldg
Date	08/09/88
Lab Log #	338094
Solids, total - percent	1.7
TOC (% dry basis)	24
BNA Compounds (ug/Kg dry wt)	
Phenol	60 U
Bis(2-Chloroethyl)Ether	60 U
2-Chlorophenol	60 U
1,3-Dichlorobenzene	60 U
1,4-Dichlorobenzene	60 U
Benzyl Alcohol	300 U
1,2-Dichlorobenzene	60 U
2-Methylphenol	60 U
Bis(2-chloroisopropyl)ether	60 U
4-Methylphenol	60 U
N-Nitroso-Di-n-Propylamine	60 U
Hexachloroethane	120 U
Nitrobenzene	60 U
Isophorone	60 U
2-Nitrophenol	300 U
2,4-Dimethylphenol	120 U
Benzoic Acid	600 U
Bis(2-Chloroethoxy)Methane	60 U
2,4-Dichlorophenol	180 U
1,2,4-Trichlorobenzene	60 U
Naphthalene	60 U
4-Chloroaniline	180 U
Hexachlorobutadiene	120 U
4-Chloro-3-Methylphenol	120 U
2-Methylnaphthalene	60 U
Hexachlorocyclopentadiene	300 U
2,4,6-Trichlorophenol	300 U
2,4,5-Trichlorophenol	300 U
2-Chloronaphthalene	60 U
2-Nitroaniline	300 U
Dimethyl Phthalate	60 U
Acenaphthylene	60 U
3-Nitroaniline	300 U
Acenaphthene	60 U
2,4-Dinitrophenol	600 U

Appendix 5. Continued.

Station Date Lab Log #	DigSldg 08/09/88 338094
4-Nitrophenol	300 U
Dibenzofuran	60 U
2,4-Dinitrotoluene	300 U
2,6-Dinitrotoluene	300 U
Diethyl Phthalate	60 U
4-Chlorophenyl-Phenylether	60 U
Fluorene	60 U
4-Nitroaniline	300 U
4,6-Dinitro-2-Methylphenol	600 U
N-Nitrosodiphenylamine	60 U
4-Bromophenyl-Phenylether	60 U
Hexachlorobenzene	60 U
Pentachlorophenol	300 U
Phenanthrene	60 U
Anthracene	60 U
Di-n-Butyl Phthalate	60 U
Fluoranthene	60 U
Pyrene	60 U
Butylbenxylphthalate	60 U
3,3'-Dichlorobenzidine	300 U
Benzo(a)Anthracene	60 U
Chrysene	60 U
Bis(2-Ethylhexyl)phthalate	2900
Di-n-Octyl Phthalate	60 U
Benzo(b)Fluoranthene}	60 U
Benzo(k)Fluoranthene}	60 U
Benzo(a)Pyrene	60 U
Indeno(1,2,3-cd)Pyrene	60 U
Dibenzo(a,h)Anthracene	60 U
Benzo(g,h,i)Perylene	60 U
<u>Pest/PCB Compounds (ug/Kg dry wt)</u>	
alpha-BHC	3.0 U
beta-BHC	3.0 U
delta-BHC	3.0 U
gamma-BHC (Lindane)	1.3 J
Heptachlor	0.8 J
Aldrin	3.0 U
Heptachlor Epoxide	3.0 U
Endosulfan I	9.0 U
Dieldrin	6.0 U

Appendix 5. Continued.

Station Date Lab Log #	DigSldg 08/09/88 338094	
4,4'-DDE	6.0 U	
Endrin	6.0 U	
Endosulfan II	6.0 U	
4,4'-DDD	6.0 U	
Endosulfan Sulfate	6.0 U	
4,4'-DDT	6.0 U	
Methoxychlor	12 U	
Endrin Ketone	6.0 U	
alpha-Chlordane}		
gamma-Chlordane} *	30 U	
Toxaphene	300 U	
Aroclor-1016	60 U	
Aroclor-1221	60 U	
Aroclor-1232	60 U	
Aroclor-1242	60 U	
Aroclor-1248	60 U	
Aroclor-1254	60 U	
Aroclor-1260	60 U	
Priority Pollutant Metals	AA or ICP (mg/kg-dw)	EP TOX, ICP (ug/L)
Antimony	0.15	
Arsenic	0.27	50 U
Beryllium	0.1 U	
Cadmium	0.35	5 U
Chromium	1.12	10 U
Copper	27.4	
Lead	7.56	50 U
Mercury		0.08 U
Nickel	5.47	
Selenium	0.38	129
Silver	0.94	6
Thallium	0.1 U	
Zinc	39.4	
Barium		210

U Indicates compound was analyzed for but not detected at the given detection limit.

J Indicates an estimated value when result is less than specified detection limit.

* total chlordane